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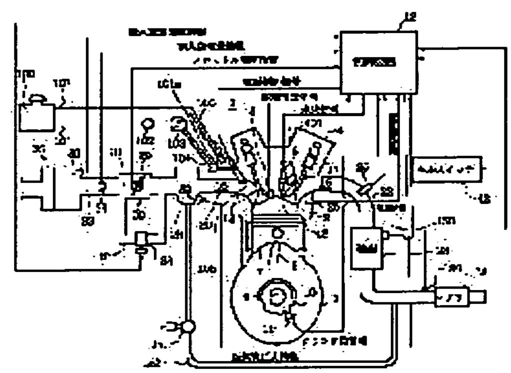
(54) ENGINE CONTROL METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To stabilize the combustion at the time of start by advancing or delaying the ignition, period and/or increasing or decreasing the fuel supply so as to obtain the target fuel ratio at the predetermined clank angle from a rear half period to the finish of combustion, which is related to the combustion condition for raising exhaust temperature, at the time of cold start.



SOLUTION: At the time of operating an engine, output signal from an intake air temperature sensor 36, a heating coil type intake air variable sensor 34, a throttle open degree sensor 31, an intake pipe pressure sensor 32, a clank angle sensor 11, an oxygen concentration sensor 25 or the like are taken into a control device 12. At the time of cold start, increase of HC and unevenness of output are restricted, and a fuel ratio at one clank angle among plural clank angles from the rear half period to the conclusion of combustion in the combustion condition, which can raise the exhaust temperature, is obtained, and this fuel ratio is set as the target value. Fuel ratio of the real combustion is detected, and in the case where this detected fuel ratio is smaller than the target value, ignition time is advanced and/or fuel supplied variable is

increased, and in the case where the detected fuel ratio is larger than the target value, ignition time is delayed and/or fuel supplied variable is reduced.

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2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1] While arranging the catalyst for exhaust air clarification to a flueway, it sets at the time of a cold start. In quest of the combustion rate in the crank angle of at least one point, this is made into desired value among the crank angles from a combustion anaphase to termination in the combustion condition which can raise an exhaust-gas temperature, suppressing HC buildup and output dispersion. the combustion rate in said crank angle in actual combustion is detected, and this detection combustion rate turns into a target combustion rate -- as -- a detection combustion rate -- desired value -- smallness -- the time -- ignition timing -- a tooth lead angle and/or fuel supply -- increasing -- The engine control approach which carries out the description for decreasing the quantity of the angle of delay and/or fuel supply for a fire stage the event of a detection combustion rate becoming size.
[Claim 2] While arranging the catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target combustion rate values at least corresponding to one side. And 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of the cold start which is activation status in case engine temperature is low temperature While it corresponds to at least one side among a load or an engine speed and holding in memory as map data of the 2nd target combustion rate value smaller than the 1st target combustion rate value The actual combustion rate to said 1 or two or more predetermined crank angles is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of said detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, the direction of the increase of fuel supply, and a detection value -- size -- an event -- a fire stage -- delaying -- and/or, the control approach of the engine characterized by making it control to increase fuel supply.
[Claim 3] While arranging the catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of this combustion condition It holds in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side, and the actual combustion rate to said 1 or two or more predetermined crank angles is detected. This combustion rate, And/or, it sets to the term control which decreases the quantity of fuel supply. the comparison with a target combustion rate -- being based -- the direction of said detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, fuel supply -- increasing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- The control approach of the engine characterized by making it compare with said detection combustion rate the value which carried out the predetermined value difference, and which was lengthened from the target combustion rate value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature as a target combustion rate value for a comparison.

[Claim 4] The actual combustion rate to said predetermined crank angle The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke initiation to ignition, The control approach of the engine according to claim 1 to 3 characterized by detecting the firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to an exhaust stroke, and making it compute based on these firing-pressure data.
[Claim 5] While arranging the catalyst for exhaust air clarification to a flueway, it sets at the time of a cold start. In quest of the crank angle in the combustion rate of at least one point, this is made into desired value among the combustion rates from a combustion anaphase to termination in the combustion condition which can raise an exhaust-gas temperature, suppressing HC buildup and output dispersion. When the detection crank angle is behind desired value so that the crank angle in said combustion rate in actual combustion may be detected and this detection crank angle may turn into a target crank angle, the quantity of a tooth lead angle and/or fuel supply is increased for ignition timing. The engine control approach which carries out the description for decreasing the quantity of the angle of delay and/or fuel supply for a fire stage the event of the detection combustion rate progressing.
[Claim 6] While arranging the catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more crank angles which reach 1 or two or more predetermined combustion rates at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target crank angle values at least corresponding to one side. And 1 or two or more crank angle values which reach 1 or two or more predetermined combustion rates at the time of the cold start which is activation status in case engine temperature is low temperature While holding in memory as map data of the 2nd crank angle value which corresponded to at least one side among the load or the engine speed, and was late for the 1st target crank angle value A actual crank angle until it reaches said 1 or two or more predetermined combustion rates is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. Set forward a fire stage the event of the direction of said detection value being behind based on the comparison with the 1st crank angle at the time of others, and/or the quantity of fuel supply is increased. The control approach of the engine characterized by making it control to delay a fire stage the event of the direction of a detection value progressing, and/or to decrease the quantity of fuel supply.
[Claim 7] While arranging the catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more crank angle values which reach 1 or two or more predetermined combustion rates at the time of this combustion condition It holds in memory among a load or an engine speed as map data of 1 or two or more target crank angles at least corresponding to one side. A actual crank angle until it reaches said 1 or two or more predetermined combustion rates is detected. Based on the comparison with this detection crank angle and a target crank angle, set forward a fire stage the event of the direction of said detection value being behind, and/or the quantity of fuel supply is increased. In the control which delays a fire stage the event of the direction of a detection value progressing, and/or increases the quantity of fuel supply The control approach of the engine characterized by making it compare with said detection crank angle the value which carried out the specified quantity angle of delay from the target crank angle value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature as a target crank angle value for a comparison.
[Claim 8] The actual crank angle which reaches said predetermined combustion rate The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke initiation to ignition, The control approach of the engine according to claim 5 to 7 characterized by detecting the firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation, and making it compute based on these firing-pressure data.
[Claim 9] While arranging the catalyst for exhaust air clarification to a flueway and injecting a fuel to a combustion chamber It is the control approach of the diesel power plant which was made to carry out spontaneous ignition according to the temperature up of a compression stroke. The

combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target combustion rate values at least corresponding to one side. And 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of the cold start which is activation status in case engine temperature is low temperature While it corresponds to at least one side among a load or an engine speed and holding in memory as map data of the 2nd target combustion rate value smaller than two or more 1 or 1st target combustion rate values The actual combustion rate to said 1 or two or more predetermined crank angles is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. And/or, a fuel-supply initiation stage is brought forward. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of said detection value -- smallness -- the time -- a fuel-injection initiation stage -- advancing -- The control approach of the engine characterized by making it control to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage when the direction of a detection value becomes size.

[Claim 10] While arranging the catalyst for exhaust air clarification to a flueway and injecting a fuel to a combustion chamber It is the control approach of the diesel power plant which was made to carry out spontaneous ignition according to the temperature up of a compression stroke. The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more crank angles which reach 1 or two or more predetermined combustion rates at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target crank angle values at least corresponding to one side. And 1 or two or more crank angle values which reach 1 or two or more predetermined combustion rates at the time of the cold start which is activation status in case engine temperature is low temperature While holding in memory as map data of the 2nd crank angle value which corresponded to at least one side among the load or the engine speed, and was late for two or more 1 or 1st target crank angle values A actual crank angle until it reaches said 1 or two or more predetermined combustion rates is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. When the direction of said detection value is behind based on the comparison with the 1st crank angle at the time of others, set forward a fuel-injection initiation stage and/or a fuel-supply initiation stage is brought forward. The control approach of the engine characterized by making it control to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage while the direction of a detection value is progressing.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the control approach of a two-cycle jump-spark-ignition engine or a four-cycle jump-spark-ignition engine.
[0002]
[Description of the Prior Art] In a two-cycle jump-spark-ignition engine or a four-cycle jump-spark-ignition engine, cooling water temperature is detected, and when this temperature is low, there are some which carry out tooth-lead-angle amendment of the ignition timing. Moreover, there are some which arrange the catalyst for exhaust air clarification.
[0003]
[Problem(s) to be Solved by the Invention] By the way, although the combination which arranges a catalyst for exhaust air clarification can be considered while carrying out tooth-lead-angle amendment of the ignition timing, when such conventional temperature is low in order to raise an engine performance Although it becomes easy to start and stability improves at the time of the idling of start up in what carries out tooth-lead-angle amendment of the fire stage at the cold machine event The temperature of the combustion chamber in a combustion anaphase falls, the temperature of emission gas falls, the exhaust air clarification function of a catalyst is low, and there is a problem which HC and the amount of black smokes in the time of starting and pre-heating, and exhaust gas increase.
[0004] This invention makes high early exhaust gas temperature after engine starting, activates a catalyst early and aims at offering the control approach of the engine which can reduce HC and the amount of black smokes in exhaust gas while being make in view of this point and stabilizing the combustion at the time of engine start up in the cold machine condition.
[0005]
[Means for Solving the Problem] In order to solve said technical problem and to attain the object, the control approach of the engine invention according to claim 1 While arranging the catalyst for exhaust air clarification to a flueway, it sets at the time of a cold start. In quest of the combustion rate in the crank angle of at least one point, this is made into desired value among the crank angles from a combustion anaphase to termination in the combustion condition which can raise an exhaust-gas temperature, suppressing HC buildup and output dispersion. the combustion rate in said crank angle in actual combustion is detected, and this detection combustion rate turns into a target combustion rate -- as -- a detection combustion rate -- desired value -- smallness -- the time -- ignition timing -- a tooth lead angle and/or fuel supply -- increasing -- It is characterized by decreasing the quantity of the angle of delay and/or fuel supply for a fire stage the event of a detection combustion rate becoming size.
[0006] Thus, suppressing HC buildup and output dispersion at the time of a cold start, it is increasing the quantity of or decreasing the quantity of a tooth lead angle or the angle of delay, and/or fuel supply for ignition timing so that it may become a target combustion rate in the combustion condition which can raise an exhaust-gas temperature, and the predetermined crank angle from a mutually related high combustion anaphase to termination, and while stabilizing the combustion at the time of start up in the cold machine condition, the catalyst is activated early.
[0007] The control approach of the engine invention according to claim 2 While arranging the

catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target combustion rate values at least corresponding to one side. And 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of the cold start which is activation status in case engine temperature is low temperature While it corresponds to at least one side among a load or an engine speed and holding in memory as map data of the 2nd target combustion rate value smaller than the 1st target combustion rate value The actual combustion rate to said 1 or two or more predetermined crank angles is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of said detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, the direction of the increase of fuel supply, and a detection value -- size -- an event -- a fire stage -- delaying -- and/or, it is characterized by making it control to increase fuel supply.
[0008] A catalyst performs exhaust air clarification and the actual combustion rate to 1 or two or more predetermined crank angles is detected. Thus, the detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, fuel supply -- increasing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- and/or, by controlling to decrease the quantity of fuel supply While stabilizing the combustion at the time of start up in the cold machine condition, exhaust gas temperature after engine starting is early made high, a catalyst is activated early, and HC and the amount of black smokes in exhaust gas are reduced.
[0009] The control approach of the engine invention according to claim 3 While arranging the catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of this combustion condition It holds in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side, and the actual combustion rate to said 1 or two or more predetermined crank angles is detected. This combustion rate, And/or, it sets to the term control which decreases the quantity of fuel supply. the comparison with a target combustion rate -- being based -- the direction of said detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, fuel supply -- increasing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- It is characterized by making it compare with said detection combustion rate the value which carried out the predetermined value difference and which was lengthened from the target combustion rate value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature as a target combustion rate value for a comparison.
[0010] A catalyst performs exhaust air clarification and the actual combustion rate to 1 or two or more predetermined crank angles is detected. Thus, this combustion rate, the comparison with a target combustion rate -- being based -- the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, fuel supply -- increasing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- and/or, although the quantity of fuel supply is decreased At the time of the cold start which is activation status in case engine temperature is low temperature While comparing with the detection combustion rate the value which carried out the predetermined value difference and which was lengthened from the target combustion rate value based on map data as a target combustion rate value for a comparison and stabilizing the combustion at the time of start up in the cold machine condition Exhaust gas temperature after engine starting is early made high, a catalyst is activated early, and HC and the amount of black smokes in exhaust gas are reduced.
[0011] The control approach of the engine invention according to claim 4 The actual combustion rate to said predetermined crank angle The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke

initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to an exhaust stroke is detected, and it is characterized by making it compute based on these firing-pressure data.
[0012] Thus, the actual combustion rate to a predetermined crank angle detects the firing pressure in at least four crank angles, and computes it based on these firing-pressure data, and ignition-timing control is performed proper.
[0013] The control approach of the engine invention according to claim 5 While arranging the catalyst for exhaust air clarification to a flueway, it sets at the time of a cold start. In quest of the crank angle in the combustion rate of at least one point, this is made into desired value among the combustion rates from a combustion anaphase to termination in the combustion condition which can raise an exhaust-gas temperature, suppressing HC buildup and output dispersion. When the detection crank angle is behind desired value so that the crank angle in said combustion rate in actual combustion may be detected and this detection crank angle may turn into a target crank angle, the quantity of a tooth lead angle and/or fuel supply is increased for ignition timing. It is characterized by decreasing the quantity of the angle of delay and/or fuel supply for a fire stage the event of the detection combustion rate progressing.
[0014] Thus, suppressing HC buildup and output dispersion at the time of a cold start, it is a tooth lead angle or carrying out the angle of delay, and/or increasing the quantity of or decreasing the quantity of fuel supply about ignition timing so that it may become the combustion condition which can raise an exhaust-gas temperature, and a target crank angle in the predetermined combustion rate from a mutually related high combustion anaphase to termination, and while stabilizing the combustion at the time of start up in the cold machine condition, the catalyst is activate early.
[0015] The control approach of the engine invention according to claim 6 While arranging the catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more crank angles which reach 1 or two or more predetermined combustion rates at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target crank angle values at least corresponding to one side. And 1 or two or more crank angle values which reach 1 or two or more predetermined combustion rates at the time of the cold start which is activation status in case engine temperature is low temperature While holding in memory as map data of the 2nd crank angle value which corresponded to at least one side among the load or the engine speed, and was late for the 1st target crank angle value A actual crank angle until it reaches said 1 or two or more predetermined combustion rates is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. It is characterized by making it control to set forward a fire stage the event of the direction of said detection value being behind based on the comparison with the 1st crank angle at the time of others, and/or to increase the quantity of fuel supply, and to delay a fire stage the event of the direction of a detection value progressing, and/or to decrease the quantity of fuel supply.
[0016] A catalyst performs exhaust air clarification and a actual crank angle until it reaches 1 or two or more predetermined combustion rates is detected. Thus, the detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. Set forward a fire stage the event of the direction of a detection value being behind based on the comparison with the 1st crank angle at the time of others, and/or the quantity of fuel supply is increased. By controlling to delay a fire stage the event of the direction of a detection value progressing, and/or to decrease the quantity of fuel supply, while stabilizing the combustion at the time of start up in the cold machine condition, exhaust gas temperature after engine starting is early made high, a catalyst is activated early, and HC and the amount of black smokes in exhaust gas are reduced.
[0017] The control approach of the engine invention according to claim 7 While arranging the catalyst for exhaust air clarification to a flueway, the combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more crank angle values which reach 1 or two or more predetermined combustion rates at the time of this combustion condition It holds in memory among a load or an engine speed as map data of 1 or two or more target crank angles at least corresponding to one side. A actual crank angle until it reaches said 1 or two or more predetermined combustion rates is detected. Based on the comparison

with this detection crank angle and a target crank angle, set forward a fire stage the event of the direction of said detection value being behind, and/or the quantity of fuel supply is increased. In the control which delays a fire stage the event of the direction of a detection value progressing, and/or increases the quantity of fuel supply It is characterized by making it compare with said detection crank angle the value which carried out the specified quantity angle of delay from the target crank angle value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature as a target crank angle value for a comparison.
[0018] Thus, a actual crank angle until a catalyst performs exhaust air clarification and it reaches 1 or two or more predetermined combustion rates is detected. Based on the comparison with this detection crank angle and a target crank angle, set forward a fire stage the event of the direction of a detection value being behind, and/or the quantity of fuel supply is increased. Delay a fire stage the event of the direction of a detection value progressing, and/or the quantity of fuel supply is decreased. The value which carried out the specified quantity angle of delay from the target crank angle value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature is compared with a detection crank angle as a target crank angle value for a comparison. While stabilizing the combustion at the time of start up in the cold machine condition, exhaust gas temperature after engine starting is early made high, a catalyst is activated early, and HC and the amount of black smokes in exhaust gas are reduced.
[0019] The control approach of the engine invention according to claim 8 The actual crank angle which reaches said predetermined combustion rate The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected, and it is characterized by making it compute based on these firing-pressure data.
[0020] Thus, the actual crank angle which reaches a predetermined combustion rate detects the firing pressure in at least four crank angles, and computes it based on these firing-pressure data, and ignition-timing control is performed proper.
[0021] The control approach of the engine invention according to claim 9 While arranging the catalyst for exhaust air clarification to a flueway and injecting a fuel to a combustion chamber It is the control approach of the diesel power plant which was made to carry out spontaneous ignition according to the temperature up of a compression stroke. The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target combustion rate values at least corresponding to one side. And 1 or two or more combustion rate values in 1 or two or more predetermined crank angles at the time of the cold start which is activation status in case engine temperature is low temperature While it corresponds to at least one side among a load or an engine speed and holding in memory as map data of the 2nd target combustion rate value smaller than two or more 1 or 1st target combustion rate values The actual combustion rate to said 1 or two or more predetermined crank angles is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. And/or, a fuel-supply initiation stage is brought forward. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of said detection value -- smallness -- the time -- a fuel-injection initiation stage -- advancing -- When the direction of a detection value becomes size, it is characterized by making it control to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage.
[0022] By control of a diesel power plant, a catalyst performs exhaust air clarification and the actual combustion rate to 1 or two or more predetermined crank angles is detected. Thus, the detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. And/or, a fuel-supply initiation stage is brought forward. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of a detection value -- smallness -- the time -- a fuel-injection initiation stage -- advancing -- The direction of a detection value size by controlling to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage, when becoming While stabilizing the combustion at the time of start up in the cold

machine condition, exhaust gas temperature after engine starting is early made high, a catalyst is activated early, and HC and the amount of black smokes in exhaust gas are reduced.
[0023] The control approach of the engine invention according to claim 10 While arranging the catalyst for exhaust air clarification to a flueway and injecting a fuel to a combustion chamber It is the control approach of the diesel power plant which was made to carry out spontaneous ignition according to the temperature up of a compression stroke. The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. 1 or two or more crank angles which reach 1 or two or more predetermined combustion rates at the time of this combustion condition It holds in memory among a load or an engine speed as map data of two or more 1 or 1st target crank angle values at least corresponding to one side. And 1 or two or more crank angle values which reach 1 or two or more predetermined combustion rates at the time of the cold start which is activation status in case engine temperature is low temperature While holding in memory as map data of the 2nd crank angle value which corresponded to at least one side among the load or the engine speed, and was late for two or more 1 or 1st target crank angle values A actual crank angle until it reaches said 1 or two or more predetermined combustion rates is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. When the direction of said detection value is behind based on the comparison with the 1st crank angle at the time of others, set forward a fuel-injection initiation stage and/or a fuel-supply initiation stage is brought forward. While the direction of a detection value is progressing, it is characterized by making it control to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage.
[0024] A actual crank angle until a catalyst performs exhaust air clarification and it reaches 1 or two or more predetermined combustion rates in control of a diesel power plant is detected. Thus, the detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. When the direction of a detection value is behind based on the comparison with the 1st crank angle at the time of others, set forward a fuel-injection initiation stage and/or a fuel-supply initiation stage is brought forward. By controlling to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage, while the direction of a detection value is progressing While stabilizing the combustion at the time of start up in the cold machine condition, exhaust gas temperature after engine starting is early made high, a catalyst is activated early, and HC and the amount of black smokes in exhaust gas are reduced.
[0025]
[Embodiment of the Invention] Hereafter, the control approach of the engine this invention is explained to a detail based on a drawing.
[0026] Drawing 1 is a block diagram of the jump-spark-ignition type four stroke cycle engine which is two or more cylinders with which this invention is applied. This engine 1 is constituted by a crank case 2, and the cylinder body 3 and the cylinder head 4 of that upper part. In a cylinder body 3, it is equipped with a piston 7 possible [sliding] through a connecting rod 8, and the connecting rod 8 is connected with the crankshaft 9. A crankshaft 9 is equipped with the flywheel starter gear 10 which have a predetermined number of teeth, and it has the crank angle sensor 11 which serves as the engine speed sensor for detecting the revolution location of these flywheel starter gear 10, and measuring a crank angle and an engine speed. A combustion chamber 13 is formed between the cylinder head 4 and a piston 7, and the ignition plug 400 is formed so that this combustion chamber 13 may be attended.
[0027] Moreover, the combustion room pressure sensor 5 for detecting the firing pressure in a combustion chamber 13 is formed in a cylinder head 4 side. The cooling water jacket 6 is formed in the suitable location of the cylinder head 4 and a cylinder body 3. In a combustion chamber 13, a flueway 15 and the inhalation-of-air path 16 are open for free passage, and an exhaust valve 17 and an inlet valve 18 are formed in the opening, respectively. In the middle of the exhaust pipe 22 connected to the flueway 15, the catalysts 23, such as a three way component catalyst for exhaust gas clarification, are established, and the muffler 24 is formed in the edge. The oxygen density sensor (O2 sensor) 25 and the exhaust pipe temperature sensor 120 are formed in an exhaust pipe 22, and it connects with the control unit 12, respectively.
[0028] The cylinder head 4 is equipped with a temperature sensor 26, and the temperature

information on a combustion chamber 13 is sent to a control unit 12. Moreover, a sensor 150 is formed in a catalyst 23 whenever [catalyst temperature / which was connected with the control unit 12]. The kill switch 43 of an engine 1 is further connected to a control device 12, and the halt information on engine drive control is acquired.

[0029] On the other hand, an inlet pipe 20 is connected to the inhalation-of-air path 16, and an inlet pipe 20 is connected with each cylinder through the inhalation-of-air distribution tube 28. The inhalation-of-air distribution tube 28 is equipped with the pressure-of-induction-pipe force sensor 32, and pressure-of-induction-pipe force information is sent to a control unit 12. The inhalation-of-air distribution tube 28 and an exhaust pipe 22 are connected, and the EGR tubing 152 is formed. The EGR regulator valve 151 connected with the control unit 12 is formed in the EGR tubing 152. An air cleaner 35 is ****(ed) by the inhalation-of-air distribution tube 28 through an inlet pipe 33. The inhalation air temperature sensor 36 is formed in an air cleaner 35, and inhalation air-temperature information is sent to a control unit 12. The inspired-air-volume regulator 30 is formed in the middle of an inlet pipe 33, and the inspired-air-volume regulator 30 is equipped with the throttle valve 29.

[0030] The throttle opening sensor 31 is formed in a throttle valve 29, and this throttle opening sensor 31 is connected with a control unit 12. The throttle-valve detour path 37 is established in the inlet pipe 33 of inspired-air-volume regulator 30 part, and the detour path opening regulator valve 38 is formed in this detour path 37. The detour path opening regulator valve 38 is connected with a control unit 12. In an inlet pipe 33, the heat ray type inhalation air content sensor 34 is formed, and inhalation air content information is sent to a control unit 12.

[0031] An injector 105 is formed in the upstream of the inlet valve 18 of the inhalation-of-air path 16 for every inlet port of each cylinder. An injector 105 is connected with a control unit 12, and the control signal of the optimal injection quantity calculated according to operational status is sent. A fuel is sent to each injector 105 through fuel pipe 101a connected with each cylinder. Fuel pipe 101a branches from the fuel distribution tube 104, it lets a fuel feeding pipe 101 pass from a fuel tank 100 to this fuel distribution tube 104, and a fuel is further sent by the fuel pump 103 through a filter 102. The fuels which were not injected from an injector 105 are collected through the fuel return pipe 107 in a fuel tank 100. A regulator 106 is formed in the fuel return pipe 107, and fuel injection pressure is kept constant.

[0032] Drawing 2 is the flow chart of the main routine which controls various engine operational status. Each step is explained below.

[0033] Step S11: Initialization is performed and initial value is set to each flag value and each variable value.

[0034] Step S12 : The inhalation air-temperature information from the inhalation air temperature sensor 36, The inhalation air content information from the heat ray type inhalation air content sensor 34, the throttle opening information from the throttle opening sensor 31, Whenever [from a sensor 150 / catalyst temperature] Information, [whenever / pressure-of-induction-pipe force information / from the pressure-of-induction-pipe force sensor 32 / and catalyst temperature] The crank angle information from the crank angle sensor 11, the temperature information from a temperature sensor 26, The exhaust pipe temperature information from the exhaust pipe temperature sensor 120, the oxygen density information from the oxygen density sensor 25, and the oil residue information from a non-illustrated oil sensor are incorporated, and the data is memorized to memory A (i). An engine load can be grasped as an accelerator location or a throttle opening. If this throttle opening and engine speed are decided, since an inhalation air content is decided the case at the time of steady operation, an inhalation air content can be detected directly and it can be regarded as an engine load. Moreover, if an engine speed is decided, since inlet-pipe negative pressure has the fixed relation to a throttle opening, inlet-pipe negative pressure can be detected and it can be regarded as an engine load.

[0035] Step S13: Incorporate switch information, such as ON of the main switch which is not illustrated [ON of the kill switch 43, OFF and], OFF and ON of a non-illustrated starting switch, and OFF, and memorize to memory B (i). The kill switch 43 is a switch for emergency shut downs, and the engine for small marine vessels is equipped with it without preparing for the engine for cars.

[0036] Step S14: Operational status judges based on the sensor information incorporated in said step 12, and the switch information incorporated at said step 13, and input the value corresponding to the

variable C in memory corresponding to this operational status **, **, **, **, **, **, **, **, **, and A**.

[0037] Operational status ** ... Beyond a predetermined value, an engine speed judges with a MBT (Minimum Advance Ignition for Best Torque) control state in the fixed accelerator condition that the rate of change of beyond a predetermined value and a throttle opening is not in the inside high-speed revolution below a predetermined value, an inside high-speed load, and a sudden acceleration-and-deceleration condition, or a ** accelerator actuation condition, and a throttle opening carries out memory of 1 to Variable C.

[0038] Operational status ** ... When the rate of change of a throttle opening is beyond a predetermined value, it judges with transient operational status and memory of 2 is carried out to Variable C.

[0039] Operational status ** ... When below a predetermined value and an engine speed are between predetermined region, for example, 1000rpm, - 5000rpm, they judge with a lean combustion control state, and a throttle opening carries out memory of 3 to Variable C.

[0040] Operational status ** ... An engine speed judges with OBAREBO more than predetermined threshold value, engine temperature judges with abnormality operational status at the time of engine abnormal conditions, such as overheat beyond a predetermined value, and memory of 4 is carried out to Variable C.

[0041] Operational status ** ... When engine temperature is below a predetermined value and a starting switch ON, it judges with a cold start condition and memory of 5 is carried out to Variable C.

[0042] Operational status ** ... At the time of a main switch OFF or the kill switch OFF, it judges with an engine shutdown demand condition, and memory of 6 is carried out to Variable C.

[0043] Operational status ** ... When below a predetermined value and Idle SW (throttle close by-pass bulb completely SW) are ON, they judge with an idle mode, and the time of clutch neutrality or an engine speed carries out memory of 7 to Variable C.

[0044] Operational status ** ... When a switch is ON in EGR control (control the recirculation of a part of exhaust gas is carried out [control] to an inhalation-of-air system), it judges with the EGR control mode, and memory of 8 is carried out to Variable C.

[0045] Operational status ** ... When beyond a predetermined value and a starting switch are ON, they usually judge with an engine start condition, and engine temperature carries out memory of 9 to Variable C.

[0046] Operational status A** ... When abnormality lifting of the combustion chamber internal pressure in front of jump spark ignition, the abnormalities in transition of a chamber pressure, etc. are detected from combustion room pressure data, it judges with abnormal-combustion conditions, such as a preignition condition and a knocking condition, and memory of 10 is carried out to Variable C.

[0047] Moreover, it is referred to as P= 0, when checking step S14 in a what time main routine with a flag P= 1 and exceeding the predetermined time R by the same variable C value.

[0048] At the time of C= 1, at the time of Rc=1C=2, the value of R will be set to Rc=1<Rc=2<Rc=3 by it at the time of Rc=2C=3, if the value of R changes the value of R as Rc=3.

[0049] It is referred to as P= 0 when the C value in the last main routine differs from this C value.

[0050] Step S15: Decision of being mode operation activation is performed, and in one case of 4, 6, and 9, it shifts to step S20, and Variable C shifts to step S16, in being other.

[0051] Step S16: Based on the value of Flag P, in the case of P= 0, ask for the target combustion rate according to an engine speed and a load, and put the result into Memory D with the map data in memory (thing equivalent to drawing 5). Moreover, a fundamental-points fire stage, a basic fuel-injection initiation stage, and basic fuel oil consumption are also calculated from the respectively same map data as drawing 5 in memory (what graphic-display-ized the value given as an engine speed and a function of a load), and are paid to memory E' (1), E' (2), and E' (3), respectively. Then, it is made P= 1. However, when Variable C is 5, P= 0 asks for a target combustion rate based on the target combustion rate map for cold starts, and makes Memory D memorize the value. In no cases of P= 1, it carries out, but they shift to step S17.

[0052] A combustion rate means the rate of the fuel which burned by whenever [over the fuel which

burns in 1 cycle combustion / a certain crank angle]. It is the approach of asking for the chamber-pressure data in two or more points predetermined [in combustion 1 cycle] in one approach by the primary approximation about the count approach of this combustion rate, and another is the approach of calculating the amount of heat release by the thermodynamic formula from the sampled pressure value, and asking for the combustion rate to a predetermined crank angle (for example, top dead center). The count result with both approaches very near true value was obtained. In this case, the data of a chamber pressure detect and ask for the chamber pressure in the crank angle of the 1st period of a before [from after termination of an exhaust stroke / the early stages of a compression stroke]. In this case, the pressure of a combustion chamber is a crank angle in within the limits in the condition of having fallen most and having approached atmospheric pressure, for example, the crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke] is a bottom dead point or its near. That is, in a four stroke cycle engine, the pressure of a combustion chamber declines and atmospheric pressure is approached as are shown in drawing 6 , and the combustion gas of a combustion chamber is discharged by the exhaust stroke from the bottom dead point after explosion and a top dead center is approached. Like the inhalation line after a top dead center, the condition near atmospheric pressure is maintained for the new air conduction close, and a pressure is gradually heightened from the compression stroke after the bottom dead point where an exhaust valve 17 closes and is started through an intake stroke. The pressure of the combustion chamber in one point is detected among the range which the pressure of such a combustion chamber declined and approached atmospheric pressure. Although the crank angle a0 in drawing 6 is taken to BDC, it may be after BDC as long as it is in early stages of a compression stroke. Of course, the crank angle in the inhalation-of-air process in front of BDC is sufficient. On the other hand, with a two-cycle engine, since new mind will be introduced from a crank case if a pressure declines, the pressure of a combustion chamber will decline further according to this if an exhaust port opens, and a scavenging port opens while the piston after explosion falls, as shown in drawing 22 , atmospheric pressure is approached. After the exhaust port has opened, a piston goes up from a bottom dead point, closing, then an exhaust port increase [a scavenging port], and a **** pressure increases [****** and compression] gradually. That is, from after termination of an exhaust stroke before the early stages of a compression stroke, after a scavenging port opens after the exhaust port opened and the exhaust port has opened after exhaust air initiation, and inhalation of air is started, between until an exhaust port closes and compression is started is said. In drawing 22 , the crank angle a0 is taken to BDC.

[0053] Jump spark ignition is performed in front of a compression backward top dead center or to the back. (Jump spark ignition is started in the crank angle expressed with an arrow head and S among drawing 6 and drawing 22 , respectively.) Jump spark ignition is started, it is slightly behind, and lights and combustion is started. The ignition initiation said by each claim is a flash when this firing combustion is started. That is, in the crank angle (drawing 22 drawing 6 , crank angle a1) of the 2nd period which is a period from compression stroke initiation to firing combustion initiation, the pressure of the **** interior of a room is detected. Then, two crank angles in the 3rd period which is a period until an exhaust stroke is started among an explosion combustion stroke from ignition initiation (firing combustion initiation) (it sets to drawing 6 and drawing 22) The pressure of a combustion chamber is detected in the crank angles a2 and a3, the crank angles a2 and a4, the crank angles a3 and a4, the crank angles a2 and a5, the crank angles a3 and a5, or the crank angles a4 and a5. As for one crank angle, it is desirable between two crank angles in this period that it is a front [crank angle / used as the highest firing pressure]. Moreover, when the pressure of a combustion chamber detects in four or more crank angles, for example, the crank angle of five or more points, said by each claim, the number of the pressure survey crank angle points of the 1st or 2nd period may be made to increase. Moreover, in three or more crank angles, pressure detection may be carried out like [it is desirable and] the example of drawing 6 and drawing 22 [within the 3rd period]. By the diesel power plant, the fuel injection before a compression backward top dead center or to an after [a top dead center] combustion chamber is started, it is behind for a while, and combustion starts by spontaneous ignition. That is, by the diesel power plant, the ignition initiation indicated to each claim means the flash when this spontaneous ignition is started. In addition, as reach, spontaneous ignition searches for the ignition delay to initiation beforehand as an engine

speed or data based on a load from fuel-injection initiation, this is woven in, it reaches and the pressure crank angle point within the pressure survey crank angle within the 2nd period and the 3rd period is memorized in memory as an engine speed or data based on a load, the pressure survey of a combustion chamber is performed.
[0054] the sum total of such 1st one period, the 2nd one period, and the 3rd two periods -- even if few, the chamber pressure of whenever [crank angle / of four points] is detected, and a combustion rate is calculated for this from a primary approximation. This approximation is combustion rate qx=a+b1*(P1-P0) +b2*(P2-P0)+... It is expressed with +bn* (Pn-P0).
[0055] As shown in a top type, to the pressure data P1-Pn, qx(es) are what applied the constant of b1-bn, and the thing which applied the constant a set up beforehand, and are expressed to what lengthened reference pressure P0 respectively.
[0056] It is what applied the constant to which C1-Cn were set beforehand, and the thing which applied the constant set up beforehand, and is expressed to that to which Pmi lengthened reference pressure P0 respectively to the pressure data P1-Pn similarly.
[0057] P0 is the chamber pressure of the point (as mentioned above for example, whenever [near the BDC / crank angle]) of atmospheric-pressure level, and in order to amend the offset voltage by the drift of a sensor etc., it is subtracted from each pressure value of P1-Pn here. Moreover, a firing pressure [in / in P1 / the crank angle a1 of the 1st period] and P2 are the chamber pressures in the crank angle a2 of the 2nd period. P3-Pn(s) are the crank angles a3-an (this example n= 5) of the 3rd period.
[0058] A value with the combustion rate actual to accuracy to the predetermined crank angle after firing and the almost same value are computed by the operation by such easy primary approximation for a short time. Therefore, while being able to take out the energy by combustion efficiently by controlling engine ignition timing and an engine air-fuel ratio using such a combustion rate, when responsibility is raised and it performs lean combustion control and EGR control, operational status can be followed exactly and output fluctuation can be suppressed. Moreover, generating of NOx by combustion advancing rapidly can be prevented. In the 2nd qx calculation approach, the heating value generated between two pressure survey points (whenever [crank angle]) the differential pressure in both the pressure survey point -- **P and a volume-of-combustion-chamber difference -- if the ratio of specific beat and R make it as an average gas constant and P0 makes amounts, such as heat, and K the pressure value in BDC, P, and V and A the pressure value and volume-of-combustion-chamber value by the side of before [of **V and the two point of measurement] It can ask as amount Qx=Aof heat release/(K-1) * (K+1) (/2***P***V+K*(P-P0) ***V+V***P).
[0059] Moreover, the combustion rate to a predetermined pressure survey point selects a crank angle when combustion is completed mostly as a pressure survey point. It is what totaled what calculated the above-mentioned amount Qx of heat release for between [every] each pressure survey point that selected similarly the crank angle near at the time of ignition as a pressure survey point, and the meantime was measured. What totaled what calculated Above Qx about the between to a predetermined pressure survey point (predetermined crank angle) from the first pressure survey point is broken.
[0060] That is, it is heating-value x100(%) =(Q1+Q2+ ... +Qx)/(Q1+Q2+ ... +Qn) x100 of the heating value/all that burned by whenever [crank angle / of combustion rate qx= arbitration].
[0061] By the above count approaches, the chamber pressure in two or more predetermined crank angles can be measured (setting to step S112 of drawing 3), and the combustion rate to a predetermined crank angle can be computed to accuracy based on the data (setting to step S292 of drawing 7). The stable output and an engine revolution are obtained by controlling an engine using this combustion rate.
[0062] Step S17: Inhalation air-temperature information and inlet-pipe negative pressure information perform the amendment operation of the injection quantity for fuel injection. That is, since air density will become low if inhalation air temperature is high, a substantial air flow rate becomes less. For this reason, the air-fuel ratio in a combustion chamber becomes low. For this reason, the amount of amendments for reducing fuel oil consumption is computed.
[0063] Step S18: The basic fuel-injection initiation according to an engine load and an engine speed, basic fuel oil consumption, and a fundamental-points fire stage are called for at step S16, and are put

in by E' (i). According to those information by which memory was carried out to the amount of amendments calculated at step S17 based on this, and memory A (i), the amount of fuel-injection amendments and the amount of ignition-timing amendments are calculated, and, in addition to a reference value, a controlled variable is calculated respectively. This controlled variable sets an ignition initiation stage to memory E (1), an ignition period is set to memory E (2), and an injection initiation stage and an injection termination stage are put into E (3) and E (4) for an injection initiation stage and an injection termination stage at F (3), F (4), and the time of P= 0 at the time of P= 1.

[0064] This is inputted into memory E (i). Similarly according to the information by which memory was carried out to memory A (i), the controlled variable of a servo motor group and a solenoid-valve group is computed, and it puts into memory G (i).

[0065] Step S19: Carry out actuation control of the actuators, such as a servo motor group and a solenoid-valve group, according to the controlled variable of memory G (i).

[0066] Step S20: An engine shutdown demand is judged, when Variable C is 6, it shifts to step S21, and in being other, it shifts to step S22.

[0067] Step S21: Set the halt data which set memory E(i) i=1-4 to 0, or carry out the flame failure of the ignition plug 400.

[0068] Step S22: Variable C judges that it is 9, when Variable C is the usual engine start of 9, shift to step S23, and when that is not right, shift to step S25.

[0069] Step S23: Set the data for making memory F (i) increase slightly the quantity of the angle of delay and fuel oil consumption for the data for start up currently beforehand put into memory, i.e., ignition timing.

[0070] Step S24: Drive a start-up motor.

[0071] Step S25: It is the case where Variable C is 4, and set the data which make the quantity of fuel oil consumption increase, extracting a throttle opening to memory F (i), if it is the data corresponding to the content of abnormalities, for example, OBAREBO, and is a flame failure and overheat.

[0072] Next, interruption routine [of drawing 3] ** is explained. This interruption routine ** will be performed by the main routine by interruption, if the crank signal of a predetermined include angle is inputted.

[0073] Step S111: Set a timer so that interruption routine ** may be performed for every predetermined crank angle, namely, so that the interrupt of whenever [following crank angle] may occur.

[0074] Step S112: Incorporate the pressure data which are whenever [crank angle / which the interrupt generated], and put into memory.

[0075] Step S113: If the pressure data of all crank angles are incorporated by memory, it will shift to step S114.

[0076] Steps S114-S115: Variable C confirms whether to be 10 or not, and, in the case of C= 10, performs and carries out the return of the abnormal-combustion prevention routine of step S115 as abnormal combustion. When that is not right, it moves to step S116.

[0077] Step S116: It confirms whether to be C= 2 and judges whether it is a transient, and it comes out so, and a transient control routine is performed by step S116a at a certain time, and it amends and carries out the return of ignition timing or A/F. Otherwise, it moves to step S117.

[0078] Step S117: It confirms whether to be C= 5, judges whether it is a cold start, and comes out so, and a cold start control routine is performed by step S117a at a certain time, and it amends and carries out the return of the ignition timing. Otherwise, it moves to step S118.

[0079] Step S118: It confirms whether to be C= 8 and judges whether it is the EGR control mode, and it comes out so, and an EGR control routine is performed by step S118a at a certain time, and it amends and carries out the return of an EGR rate or the ignition timing. Moreover, if that is not right, it will move to step S119.

[0080] Step S119: It confirms whether to be C= 3, judges whether it is lean combustion mode, and comes out so, and a lean combustion control routine is performed by step S119a at a certain time, and it amends and carries out the return of A/F or the ignition timing. Moreover, if that is not right, it will move to step S120.

[0081] Step S120: It confirms whether to be C= 7 and judges whether it is idling mode, and it comes out so, and an idling control routine is performed by step S120a at a certain time, and it amends and carries out the return of A/F or the ignition timing. Moreover, if that is not right, a MBT control routine will be performed at step S121, and the return of the ignition timing will be amended and carried out.
[0082] Next, interruption routine [of drawing 4] ** is explained. This interruption routine ** will be performed by the main routine by interruption, if a criteria crank signal is inputted.
[0083] Step S121: Since this interruption routine ** is performed once in an engine revolution and a predetermined crank angle, it measures a period.
[0084] Step S122: Calculate an engine speed.
[0085] Step S123: Set an ignition initiation stage, an ignition termination stage, an injection initiation stage, and an injection termination stage to a timer based on the control data of memory F(i) i=1-4. A timer starts an ignition and a fuel injection equipment to the set timing.
[0086] Next, the calculation of a target combustion rate explained by drawing 2 and drawing 3 is explained to a detail.
[0087] Drawing 5 is drawing of the map for asking for the target combustion rate according to an engine speed and a load. It asks from what map-ized the predetermined crank angle, for example, the combustion rate to a top dead center TDC, as a target combustion rate at the time of lean combustion, and memory is carried out to the storage of a control unit 12. The configuration of the three dimensions as which a target combustion rate is determined by a load (Lx) and the engine speed (Rx) is shown. The target combustion rate in a predetermined service condition (Lx, Rx) is called for as FMB0 (Lxi, Rxi) and i=1-n.
[0088] According to operational status, the target combustion rate data in two or more crank angles are given as target combustion rate data. For example, the target combustion rate data of the predetermined crank angle in early stages of combustion and two or more predetermined crank angles of a combustion anaphase are given.
[0089] Drawing 6 is the graph of the chamber pressure of 1 cycle combustion of a four stroke cycle engine. As for an axis of ordinate, an axis of abscissa shows a firing pressure whenever [crank angle]. The firing pressures P0-P5 in six points of a0-a5 which whenever [crank angle] illustrated are detected, and a combustion rate is computed based on these pressure values. a0 is a bottom dead point location (BDC) which moves from inhalation to compression, and is in the condition almost near atmospheric pressure. a1 is after compression initiation and a2 is the crank angle before arriving at a top dead center (TDC) after jump spark ignition in S before jump spark ignition. Four points of a3-a5 are the crank angles which can be set like the explosion line after a top dead center. A combustion rate is computed based on the pressure data of these each point. In addition, in the case of the diesel power plant by which jump spark ignition is not carried out, a fuel is injected [near the top dead center] like FI. It is behind time to be equivalent to the crank angle after [d] injection initiation, and spontaneous ignition is carried out. The crank angle of spontaneous ignition is set to S. In this diesel power plant, control of fuel injection timing is carried out based on the difference between a target combustion rate or a target crank angle instead of control of ignition timing in an ignition spark system engine, respectively in a location survey combustion rate or a location survey crank angle. The tooth lead angle and angle-of-delay control of the injection initiation stage are carried out, and an injection termination stage is controlled so that the predetermined injection quantity is secured.
[0090] Next, the cold start control explained by drawing 2 and drawing 3 is explained to a detail. Drawing 7 is a cold start control routine in the case of having a desired value map.
[0091] Switch S291: Load a target combustion rate from a desired value map, and move to a switch S292.
[0092] Switch S292: Compute a actual combustion rate, perform a back load, and move to a switch S293.
[0093] Switch S293: Perform an ignition-timing control routine and move to a switch S294.
[0094] Switch S294: Store and carry out the return of the correction value of ignition timing.
[0095] In this cold start control, the following **s, **, <GAI ID=0003>**, **, **, **, **, **, **, or the A**s are performed.

[0096] First, in cold start control **, while arranging the catalyst for exhaust air clarification to a flueway, it sets at the time of a cold start. In quest of the combustion rate in the crank angle of at least one point, this is made into desired value among the crank angles from a combustion anaphase to termination in the combustion condition which can raise an exhaust-gas temperature, suppressing HC buildup and output dispersion. the combustion rate in said crank angle in actual combustion is detected, and this detection combustion rate turns into a target combustion rate -- as -- a detection combustion rate -- desired value -- smallness -- the time -- ignition timing -- a tooth lead angle and/or fuel supply -- increasing -- The quantity of the angle of delay and/or fuel supply is decreased for a fire stage the event of a detection combustion rate becoming size.
[0097] Next, in cold start control **, while arranging the catalyst for exhaust air clarification to a flueway The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. The combustion rate value in the predetermined crank angle at the time of this combustion condition is held in memory among a load or an engine speed as map data of the 1st target combustion rate value at least corresponding to one side. And the combustion rate value in the predetermined crank angle at the time of the cold start which is activation status in case engine temperature is low temperature While it corresponds to at least one side among a load or an engine speed and holding in memory as map data of the 2nd target combustion rate value smaller than the 1st target combustion rate value The actual combustion rate to a predetermined crank angle is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of said detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, fuel supply -- increasing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- and/or, it controls to decrease the quantity of fuel supply.
[0098] In cold start control **, while arranging the catalyst for exhaust air clarification to a flueway The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. The combustion rate value in the predetermined crank angle at the time of this combustion condition is held in memory among a load or an engine speed as map data of the target combustion rate value at least corresponding to one side. Detect the actual combustion rate to a predetermined crank angle, and it is based on the comparison with this combustion rate and a target combustion rate. And/or, it sets to the control which decreases the quantity of fuel supply. the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, fuel supply -- increasing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- The value which carried out the predetermined value difference and which was lengthened from the target combustion rate value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature is compared with a detection combustion rate as a target combustion rate value for a comparison.
[0099] In cold start control **, it sets to either cold start control **, **, ** or ** that carries out the following. The actual combustion rate to a predetermined crank angle The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to an exhaust stroke is detected, and it computes based on these firing-pressure data.
[0100] In cold start control **, while arranging the catalyst for exhaust air clarification to a flueway, it sets at the time of a cold start. In quest of the crank angle in the combustion rate of at least one point, this is made into desired value among the combustion rates from a combustion anaphase to termination in the combustion condition which can raise an exhaust-gas temperature, suppressing HC buildup and output dispersion. When the detection crank angle is behind desired value so that the crank angle in said combustion rate in actual combustion may be detected and this detection crank angle may turn into a target crank angle, the quantity of a tooth lead angle and/or fuel supply is increased for ignition timing. The quantity of the angle of delay and/or fuel supply is decreased for a fire stage the event of the detection combustion rate progressing.
[0101] In cold start control **, while arranging the catalyst for exhaust air clarification to a flueway The combustion condition that correspond to at least one side among a load or an engine speed, and

stable combustion is obtained is acquired. The crank angle which reaches the predetermined combustion rate at the time of this combustion condition is held in memory among a load or an engine speed as map data of the 1st target crank angle value at least corresponding to one side. And the crank angle value which reaches the predetermined combustion rate at the time of the cold start which is activation status in case engine temperature is low temperature While holding in memory as map data of the 2nd crank angle value which corresponded to at least one side among the load or the engine speed, and was late for the 1st target crank angle value A actual crank angle until it reaches a predetermined combustion rate is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. It controls to set forward a fire stage the event of the direction of a detection value being behind based on the comparison with the 1st crank angle at the time of others, and/or to increase the quantity of fuel supply, and to delay a fire stage the event of the direction of a detection value progressing, and/or to decrease the quantity of fuel supply.
[0102] In cold start control **, while arranging the catalyst for exhaust air clarification to a flueway The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. The crank angle value which reaches the predetermined combustion rate at the time of this combustion condition is held in memory among a load or an engine speed as map data of the target crank angle at least corresponding to one side. Detect a actual crank angle until it reaches a predetermined combustion rate, and it is based on the comparison with this detection crank angle and a target crank angle. In the control which sets forward a fire stage the event of the direction of a detection value being behind, and/or increases the quantity of fuel supply, and delays a fire stage the event of the direction of a detection value progressing, and/or increases the quantity of fuel supply The value which carried out the specified quantity angle of delay from the target crank angle value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature is compared with a detection crank angle as a target crank angle value for a comparison.
[0103] In cold start control **, the actual crank angle which reaches a predetermined combustion rate in either cold start control **, **, ** or A** that carries out the following The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected, and it computes based on these firing-pressure data.
[0104] While arranging the catalyst for exhaust air clarification to a flueway and injecting a fuel to a combustion chamber in cold start control ** It is the control approach of the diesel power plant which was made to carry out spontaneous ignition according to the temperature up of a compression stroke. The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. The combustion rate value in the predetermined crank angle at the time of this combustion condition is held in memory among a load or an engine speed as map data of the 1st target combustion rate value at least corresponding to one side. And the combustion rate value in the predetermined crank angle at the time of the cold start which is activation status in case engine temperature is low temperature While it corresponds to at least one side among a load or an engine speed and holding in memory as map data of the 2nd target combustion rate value smaller than the 1st target combustion rate value The actual combustion rate to a predetermined crank angle is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of a detection value -- smallness -- the time -- a fuel-injection initiation stage -- advancing -- and/or, a fuel-supply initiation stage -- bringing forward -- the direction of a detection value -- size -- the time -- a fuel-injection initiation stage -- delaying -- and/or, it controls to make a fuel-supply initiation stage late.
[0105] While arranging the catalyst for exhaust air clarification to a flueway and injecting a fuel to a combustion chamber in cold start control A** It is the control approach of the diesel power plant which was made to carry out spontaneous ignition according to the temperature up of a compression stroke. The combustion condition that correspond to at least one side among a load or an engine speed, and stable combustion is obtained is acquired. The crank angle which reaches the

predetermined combustion rate at the time of this combustion condition is held in memory among a load or an engine speed as map data of the 1st target crank angle value at least corresponding to one side. And the crank angle value which reaches the predetermined combustion rate at the time of the cold start which is activation status in case engine temperature is low temperature While holding in memory as map data of the 2nd crank angle value which corresponded to at least one side among the load or the engine speed, and was late for the 1st target crank angle value A actual crank angle until it reaches a predetermined combustion rate is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. While a fuel-injection initiation stage is set forward, and/or a fuel-supply initiation stage is brought forward, when the direction of said detection value is behind based on the comparison with the 1st crank angle at the time of others, and the direction of a detection value is progressing, it controls to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage.
[0106] Drawing 8 is drawing showing the relation between the combustion rate at the time of a predetermined crank angle, and an exhaust-gas temperature. For example, when crank angle thetaobj (s) are 50 ATDC(s), the combustion rate FMBij is 70% of abbreviation, an exhaust-gas temperature is high and it is possible to activate a catalyst early and to reduce HC and the amount of black smokes in exhaust gas.
[0107] Drawing 9 is a graph which shows the relation between a crank angle and the gas temperature in a cylinder. In the case of early ignition timing, in the case of a reference point fire stage, 9B of 9A is the case of ignition timing when 9C is late. In the case of the early ignition timing Ig of 9A, the gas temperature in a cylinder in the second half of combustion becomes low from the case of the late ignition timing Ig of 9C. Therefore, in order to activate a catalyst early, ignition timing is delayed from the case of the reference point fire stage of 9B. That is, the combustion rate to a predetermined crank angle is usually set up smaller than the case of criteria.
[0108] Drawing 10 is a graph which shows the combustion rate at the time of a predetermined crank angle, and correlation of HC and a NOx discharge. Moreover, drawing 11 is a graph which shows the combustion rate at the time of a predetermined crank angle, and correlation of output dispersion. For example, the combustion percentage FMBij at the time of predetermined crank angle ATDC50" is 70%, there are few HC and NOx discharges and output dispersion is also small.
[0109] Drawing 12 is drawing showing change of the combustion rate FMB by ignition-timing actuation. When the tooth lead angle of the 12A is being carried out from proper ignition timing, 12B shows the case where the angle of delay is carried out from proper ignition timing, and if the combustion rate of the location survey in a predetermined crank angle (for example, B) is a1 [larger] than a target combustion rate (for example, A), it will carry out the angle of delay of proper ignition-timing and 12C. Moreover, if it is a2 [smaller than a target combustion rate (for example A)], a tooth lead angle will be carried out.
[0110] Moreover, if the crank angle of the location survey which reaches a predetermined combustion rate (for example, A) is b2 [larger] than a target crank angle (for example, B), a tooth lead angle will be carried out. If it is b1 [smaller than a target crank angle (for example, B)], the angle of delay will be carried out.
[0111] Moreover, a target crank angle is searched for with the map data of drawing 13 . That is, in drawing 13 , when target crank angle CRAs0 (Rx, Lx) which are setting to target crank angle CRA which should reach a predetermined combustion rate, and should reach an axis of abscissa at a load (L) and an axis of ordinate to a predetermined combustion rate, for example, 60%, 70%, 80 etc.%, etc. are actual engine-speed rpm (Rx) and a actual engine load (Lx), it asks from a map.
[0112] Drawing 14 is drawing showing the relation between whenever [crank angle / at the time of a predetermined combustion rate], and an exhaust-gas temperature. For example, when the combustion rate FMBobi is 70% of abbreviation, abbreviation crank angle thetaobj(s) are 50 ATDC (s), an exhaust-gas temperature is high and it is possible to activate a catalyst early and to reduce HC and the amount of black smokes in exhaust gas.
[0113] Drawing 15 is a graph which shows whenever [crank angle / at the time of a predetermined combustion rate], and correlation of HC and a NOx discharge. Drawing 16 is a graph which shows whenever [crank angle / at the time of a predetermined combustion rate], and output dispersion. For example, thetaij(s) are 50 ATDC(s) whenever [crank angle / in case the predetermined combustion

percentage FMBij is 70%], there are few HC and NOx discharges and output dispersion is also small.

[0114] Drawing 17 shows the flow chart of the cold star routine which an exhaust-gas temperature is raised and promotes activation of an exhaust gas clarification catalyst, without causing unstable combustion and aggravation of the discharge of HC by obtaining the optimal firing stage and combustion speed by feedback amendment control of ignition timing and the amount of fuel supply.

[0115] It has a target combustion rate in two or more crank angles, make an early combustion rate into the desired value for controlling a firing stage, and let the change rate of the combustion rate between at least two crank angles be the desired value for rate-of-combustion control. As for rate-of-combustion control, firing stage control makes ignition timing the control input of the amount of fuel supply. this control input -- the difference of desired value and a detection value -- feedback -- things determine.

[0116] Step S500: Read the target combustion rate in a current engine speed and two or more crank angles corresponding to a load from the map memorized as target data at the time of lean combustion. The above is performed and it moves to step S501.

[0117] Step S501: Calculate the target rate of combustion from two or more target rates read at step S500. For example, the target rate of combustion BSPD is what **(ed) a changed part of the combustion rate of whenever [two crank angle] at spacing whenever [crank angle], and is called for.

[0118] BSPDthetal2=(FMBtheta2-FMBthetal)/(theta2-thetal)

When the desired value read in MABBU carries out combustion speed and is set up at FMBtheta2>FMBtheta1 and theta2>theta1 step S500, activation of step S501 is unnecessary. The above is performed and it moves to step S502.

[0119] Step S502: Calculate the actual combustion rate in two or more crank angles to which the target combustion rate is set (it is henceforth called a detection value and a detection combustion rate). From now on, combustion speed will also be calculated by the same formula as step S501. Next, it moves to step S503.

[0120] Step S503: Take the deflection of desired value and a detection value. For example, deflection **FBM of a combustion rate is calculated according to the detection combustion rate FMB (theta 1) and the difference of target combustion rate FMBtheta1.

[0121] Deflection **BSPD of combustion speed is calculated like **FMB=FMB(theta 1)-FMBtheta1 according to the detection combustion speed BSPD (theta 12), target combustion speed, and the difference of BSPDtheta12.

[0122]

More than **BSPD=BSPD(theta 12)-BSPDtheta12 is calculated and it moves to step S504.

[0123] Step S504: Check the feedback prohibition flag of the amount amendment control of fuel supply. When a feedback prohibition flag is ON, it moves to step S509 and amendment control of the amount of fuel supply is not performed. Moreover, when a feedback prohibition flag is OFF, it moves to step S505, and processing is continued. Even if the feedback prohibition flag of combustion amount-of-supply amendment control is among feedback amendment mode, it may be turned on. For example, when a load effect and fluctuation of an engine speed are large, a flag is turned on, and feedback amendment of the amount of fuel supply is forbidden.

[0124] Step S505: Amendment control of the amount of fuel supply judges whether it is under [delay cycle] ********. A delay cycle is a cycle for giving and performing an interval to amendment. This absorbs the delay of a response, and surge-fluctuation. Amendment control will be performed if a delay counter is set to O, and it moves from it to step S506.

[0125] Step S506: Here, the deflection of desired value and a detection value confirms whether it is the inside of an allowed value. This allowed value is prepared and engine hunting is prevented. If it becomes in an allowed value, amendment control will not be carried out but it will move to step S508. Otherwise, it moves to step S507 and amendment control of the amount of fuel supply is performed.

[0126] Step S507: Perform the amendment routine of the amount of fuel supply of drawing 19 , and move to step S508.

[0127] Step S508: Set a predetermined value to a delay counter so that it may become a count delay

cycle of predetermined from next time, and move to step S509.
[0128] Step S506b: Reduce by one from the delay counter of amendment control of the amount of fuel supply, and move to step S507b.
[0129] Step S507b: Equalize deflection. Moreover, the rate of change of a detection value can be calculated and the validity of amendment can also be evaluated in quest of the stability of combustion. It moves to step S509, without amending by performing the above.
[0130] Step S509: Judge whether it is the delay cycle of ignition-timing amendment control. A delay cycle is a cycle for giving and performing an interval to amendment, and surge-fluctuation is absorbed. Amendment control will be performed if a delay counter is set to 0, and it moves from it to step S510. When that is not right, it moves to step S510b.
[0131] Step S510: Here, the deflection of desired value and a detection value confirms whether it is the inside of an allowed value. Engine hunting is prevented by this allowed value. If it becomes in an allowed value, amendment control will not be carried out but it will move to step S512. Otherwise, it moves to step S511 and amendment control of ignition timing is performed.
[0132] Step S511: Perform the amendment routine of ignition timing of drawing 18 , and move to step S512.
[0133] Step S512: Set and carry out the return of the predetermined value to a delay counter so that it may become a count delay cycle of predetermined from next time.
[0134] Step S510b: Reduce by one from the delay counter of ignition-timing amendment control, and move to step S51Ob.
[0135] Step S511b: Perform the average of deflection. Moreover, the rate of change of a detection value can be calculated and the validity of amendment can also be evaluated in quest of the stability of a period. A return is carried out without amending by performing the above.
[0136] Next, the ignition-timing amendment routine in the case of calculating correction value according to deflection is shown in drawing 18 . An operation of this ignition-timing amendment routine is shown in drawing 20 .
[0137] Step S151: Take deflection deltaFMB of the target combustion rate FMB and the actual value FMB (theta), and move to step S152.
[0138] Step S152: According to deflection deltaFMB, read the amendment variation gi in a map and move to step S153.
[0139] Step S153: Add the amendment variation gi to the ignition-timing correction value IGTD to last time, consider as the ignition-timing correction value IGTD, and move to step S154.
[0140] Step S154: If the ignition-timing correction value IGTD is forward, it will move to step S155a. If it is negative or 0, it will move to step S155b.
[0141] Step [step S155a -] S156a: If close does not require the ignition-timing correction value IGTD for the limit IGTDS by the side of a tooth lead angle, perform step S156a and carry out a return, applying a limit. If Limit IGTDS requires close, a return will be carried out as it is.
[0142] Step [step S155b -] S156b: If close does not require the ignition-timing correction value IGTD for the limit IGTDR by the side of the angle of delay, perform step S156b and carry out a return, applying a limit. If Limit IGTDR requires close, a return will be carried out as it is.
[0143] Next, the amount amendment routine of fuel supply in the case of calculating correction value according to deflection is shown in drawing 18 . An operation of this amount amendment routine of fuel supply is shown in drawing 21 .
[0144] Step S171: Take deflection deltaFMB of the target combustion rate FMB and the actual value FMB (theta), and move to step S172.
[0145] Step S172: Read the amendment variation gf in a map according to deflection deltaFMB, and move to step S173.
[0146] Step S173: Add the amendment variation gf to the correction value FTD of the amount of fuel supply to last time, consider as the correction value FTD of the amount of fuel supply, and move to step S174.
[0147] Step S174: If the correction value FTD of the amount of fuel supply is forward, it will move to step S175a. If it is negative or 0, it will move to step S175b.
[0148] Step [step S175a -] S176a: If close does not require the correction value FTD of the amount of fuel supply for the limit FTDMX by the side of loading, perform step S176a and carry out a

return, applying a limit. If Limit FTDMX requires close, a return will be carried out as it is.
[0149] Step [step S175b -] S176b: If close does not require the correction value FTD of the amount of fuel supply for the limit FTDMN by the side of loss in quantity, perform step S176b and carry out a return, applying a limit. If Limit FTDMN requires close, a return will be carried out as it is.
[0150] Drawing 22 is the same graph of a chamber pressure as the above-mentioned four stroke cycle engine and drawing 6 to show the point for combustion rate measurement of said two-cycle engine detecting [combustion pressure data]. As mentioned above, chamber-pressure data are sampled whenever [crank angle / of six points]. Within the limits of an in [drawing] A is a crank angle field as for which the exhaust port is carrying out opening, and within the limits of B is a crank angle field as for which the scavenging port is carrying out opening. How to take whenever [each crank angle] (a0-a5) and the count approach are the same on the above-mentioned four stroke cycle engine and parenchyma, are step S113 of interruption routine ** of drawing 3 , detect the firing pressures P0-P5 in six points of a0-a5 which whenever [crank angle] illustrated, and compute a combustion rate based on these pressure values. Each example of this invention can adopt what supplies combustion with a carburetor.
[0151]
[Effect of the Invention] As having described above, invention according to claim 1 can activate a catalyst early, suppressing HC buildup and output dispersion at the time of a cold start while stabilizing the combustion at the time of start up in the cold machine condition by increasing the quantity of or decreasing the quantity of a tooth lead angle or the angle of delay, and/or fuel supply for ignition timing so that it may become a target combustion rate in the combustion condition which can raise an exhaust-gas temperature, and the predetermined crank angle from a mutually related high combustion anaphase to termination.
[0152] Invention according to claim 2 performs exhaust air clarification according to a catalyst, and the actual combustion rate to 1 or two or more predetermined crank angles is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. And/or, the quantity of fuel supply is increased. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- Since it controls to delay a fire stage the event of the direction of a detection value becoming size, and/or to decrease the quantity of fuel supply, while stabilizing the combustion at the time of start up in the cold machine condition, exhaust gas temperature after engine starting can be early made high, a catalyst can be activated early, and HC and the amount of black smokes in exhaust gas can be reduced.
[0153] Invention according to claim 3 performs exhaust air clarification according to a catalyst, and the actual combustion rate to 1 or two or more predetermined crank angles is detected. This combustion rate, the comparison with a target combustion rate -- being based -- the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- and/or, fuel supply -- increasing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- and/or, although the quantity of fuel supply is decreased At the time of the cold start which is activation status in case engine temperature is low temperature Since ignition timing is further controlled for the value which carried out the predetermined value difference and which was lengthened from the target combustion rate value based on map data proper as a target combustion rate value for a comparison as compared with a detection combustion rate, while stabilizing the combustion at the time of start up in the cold machine condition Exhaust gas temperature after engine starting can be early made high, a catalyst can be activated early, and HC and the amount of black smokes in exhaust gas can be reduced.
[0154] Since the actual combustion rate to 1 or two or more predetermined crank angles detects the firing pressure in at least four crank angles and invention according to claim 4 computes it based on these firing-pressure data, more, it is easy data calculation and it can perform ignition-timing control proper.
[0155] It can activate a catalyst early while ignition timing stabilizes the combustion at the time of start up in the cold machine condition by the tooth lead angle or carrying out the angle of delay, invention according to claim 5 suppressing HC buildup and output dispersion at the time of a cold start so that it may become the combustion condition which can raise an exhaust-gas temperature, and a target crank angle in the predetermined combustion rate from a mutually related high

combustion anaphase to termination.
[0156] Invention according to claim 6 performs exhaust air clarification according to a catalyst, and a actual crank angle until it reaches 1 or two or more predetermined combustion rates is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. Set forward a fire stage the event of the direction of a detection value being behind based on the comparison with the 1st crank angle at the time of others, and/or the quantity of fuel supply is increased. Since it controls to delay a fire stage the event of the direction of a detection value progressing, and/or to decrease the quantity of fuel supply, while stabilizing the combustion at the time of start up in the cold machine condition Exhaust gas temperature after engine starting can be early made high, a catalyst can be activated early, and HC and the amount of black smokes in exhaust gas can be reduced.
[0157] A actual crank angle until invention according to claim 7 performs exhaust air clarification according to a catalyst and it reaches 1 or two or more predetermined combustion rates is detected. Based on the comparison with this detection crank angle and a target crank angle, set forward a fire stage the event of the direction of a detection value being behind, and/or the quantity of fuel supply is increased. Delay a fire stage the event of the direction of a detection value progressing, and/or the quantity of fuel supply is increased the quantity of or decreased. The value which carried out the specified quantity angle of delay from the target crank angle value based on map data at the time of the cold start which is activation status in case engine temperature is low temperature is compared with a detection combustion rate as a target crank angle value for a comparison. Since ignition timing is furthermore controlled proper, while stabilizing the combustion at the time of start up in the cold machine condition, exhaust gas temperature after engine starting can be early made high, a catalyst can be activated early, and HC and the amount of black smokes in exhaust gas can be reduced.
[0158] Since the actual crank angle which reaches a predetermined combustion rate detects the firing pressure in at least four crank angles and invention according to claim 8 computes it based on these firing-pressure data, more, it is easy data calculation and it can perform ignition-timing control proper.
[0159] Invention according to claim 9 is control of a diesel power plant, a catalyst performs exhaust air clarification, and the actual combustion rate to 1 or two or more predetermined crank angles is detected. The detection value of this combustion rate, It is based on the comparison with the 2nd target combustion rate at the time of a cold start. And/or, a fuel-supply initiation stage is brought forward. the time of others -- the comparison with the 1st target combustion rate -- being based -- the direction of a detection value -- smallness -- the time -- a fuel-injection initiation stage -- advancing -- Since it controls to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage when the direction of a detection value becomes size, while stabilizing the combustion at the time of start up in the cold machine condition Exhaust gas temperature after engine starting can be early made high, a catalyst can be activated early, and HC and the amount of black smokes in exhaust gas can be reduced.
[0160] Invention according to claim 10 is control of a diesel power plant, a catalyst performs exhaust air clarification, and a actual crank angle until it reaches 1 or two or more predetermined combustion rates is detected. The detection value of this crank angle, It is based on the comparison with the 2nd target crank angle at the time of a cold start. When the direction of a detection value is behind based on the comparison with the 1st crank angle at the time of others, set forward a fuel-injection initiation stage and/or a fuel-supply initiation stage is brought forward. Since it controls to delay a fuel-injection initiation stage and/or to delay a fuel-supply initiation stage while the direction of a detection value is progressing, while stabilizing the combustion at the time of start up in the cold machine condition Exhaust gas temperature after engine starting can be early made high, a catalyst can be activated early, and HC and the amount of black smokes in exhaust gas can be reduced.

[Translation done.]

DESCRIPTION OF DRAWINGS

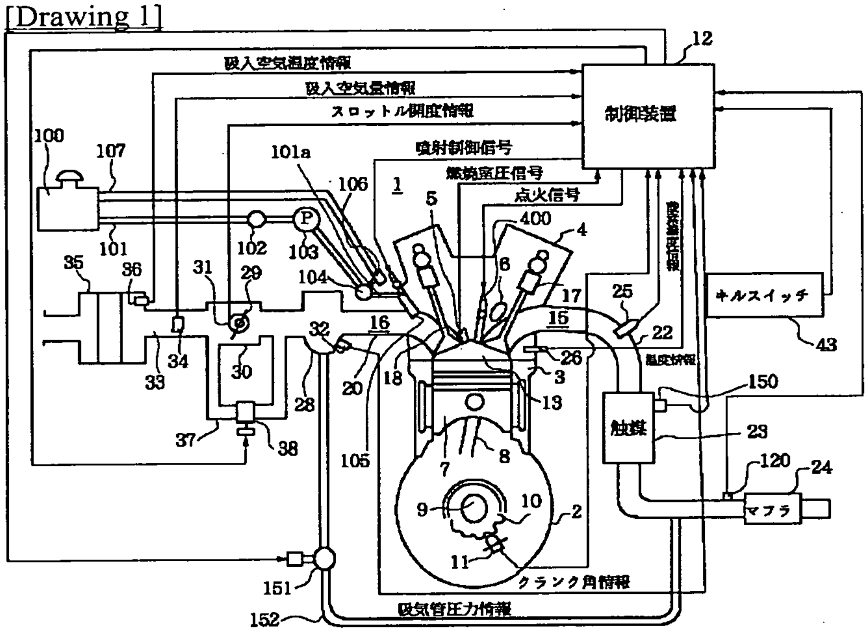
[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the jump-spark-ignition type four stroke cycle engine which is two or more cylinders with which this invention is applied.
[Drawing 2] It is the flow chart of the main routine which controls various engine operational status.
[Drawing 3] It is drawing showing interruption routine **.
[Drawing 4] It is drawing showing interruption routine **.
[Drawing 5] It is drawing of the map for asking for the target combustion rate according to an engine speed and a load.
[Drawing 6] It is the graph of the chamber pressure of 1 cycle combustion of a four stroke cycle engine.
[Drawing 7] It is a cold start control routine in the case of having a desired value map.
[Drawing 8] It is drawing showing the relation between the combustion rate at the time of a predetermined crank angle, and an exhaust-gas temperature.
[Drawing 9] It is the graph which shows the relation between a crank angle and the gas temperature in a cylinder.
[Drawing 10] It is the graph which shows the combustion rate at the time of a predetermined crank angle, and correlation of HC and a NOx discharge.
[Drawing 11] It is the graph which shows the combustion rate at the time of a predetermined crank angle, and correlation of output dispersion.
[Drawing 12] It is drawing showing change of the combustion rate FMB by ignition-timing actuation.
[Drawing 13] It is drawing of the map for asking for the target combustion rate according to an engine speed and a load.
[Drawing 14] It is drawing showing the relation between whenever [crank angle / at the time of a predetermined combustion rate], and an exhaust-gas temperature.
[Drawing 15] It is the graph which shows whenever [crank angle / at the time of a predetermined combustion rate], and correlation of HC and a NOx discharge.
[Drawing 16] It is the graph which shows whenever [crank angle / at the time of a predetermined combustion rate], and output dispersion.
[Drawing 17] It is the flow chart of a cold start routine.
[Drawing 18] It is an ignition-timing amendment routine in the case of calculating correction value according to deflection.
[Drawing 19] It is the amount amendment routine of fuel supply in the case of calculating correction value according to deflection.
[Drawing 20] It is drawing showing change of the combustion rate FMB by ignition-timing actuation.
[Drawing 21] It is drawing showing change of the combustion rate FMB by the amount actuation of fuel supply.
[Drawing 22] It is the same graph of a chamber pressure as drawing 6 of the above-mentioned four stroke cycle engine to show the point for measurement of the output torque and combustion rate of a two-cycle engine detecting [combustion pressure data].
[Description of Notations]

1 Engine
9 Crankshaft
10 Flywheel Starter Gear
11 Crank Angle Sensor
12 Control Unit
13 Combustion Chamber
25 Oxygen Density Sensor (O2 Sensor)
26 Temperature Sensor
31 Throttle Opening Sensor
32 Pressure-of-Induction-Pipe Force Sensor
34 Heat Ray Type Inhalation Air Content Sensor
36 Inhalation Air Temperature Sensor
105 Injector
106 Regulator
120 Exhaust Pipe Temperature Sensor
150 It is Sensor whenever [Catalyst Temperature].

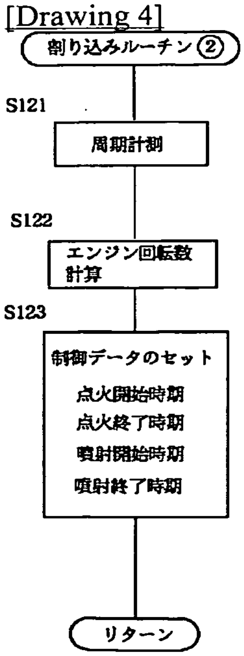
[Translation done.]

DRAWINGS

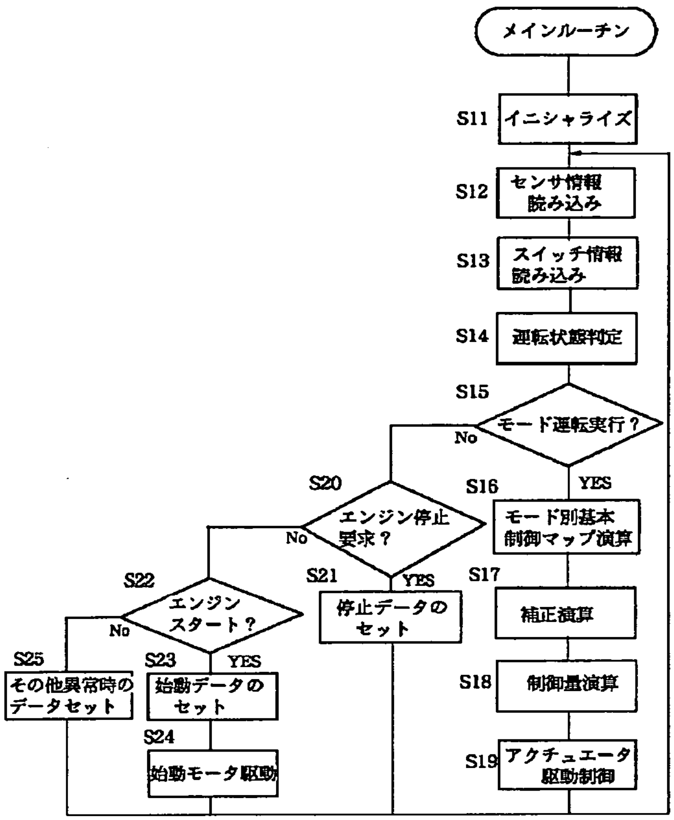
[Drawing 1]



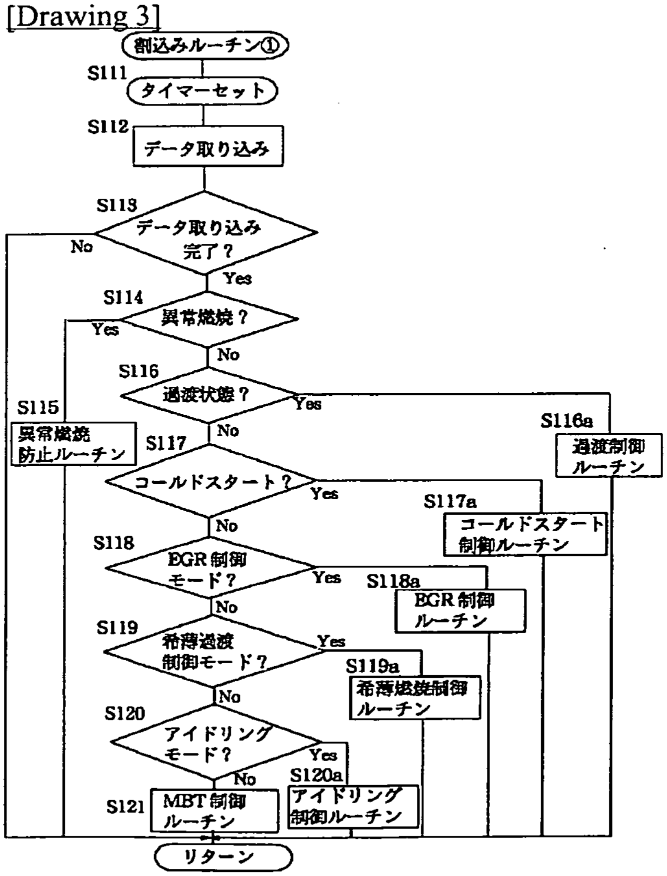
[Drawing 4]



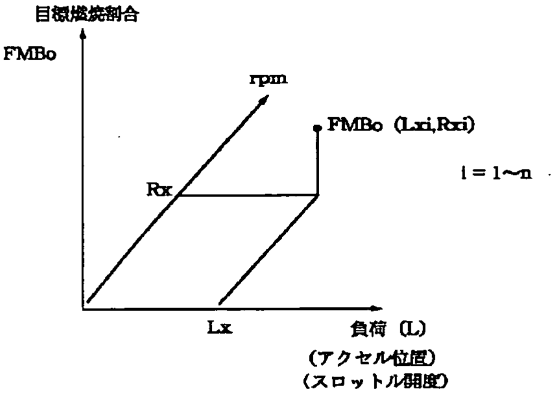
[Drawing 2]



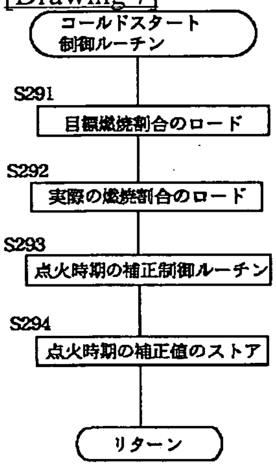
[Drawing 3]



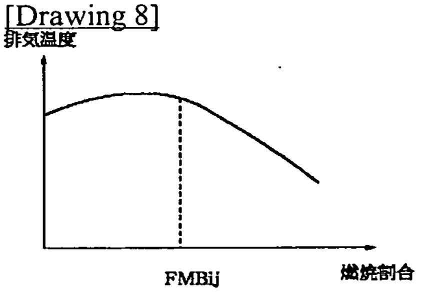
[Drawing 5]



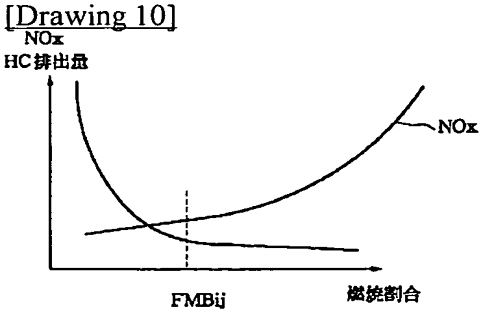
[Drawing 7]



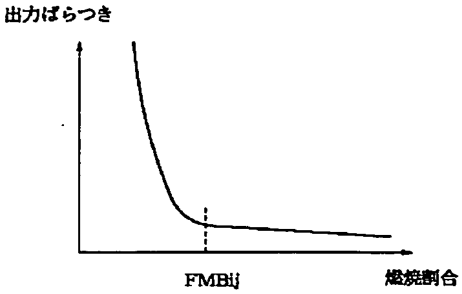
[Drawing 8]



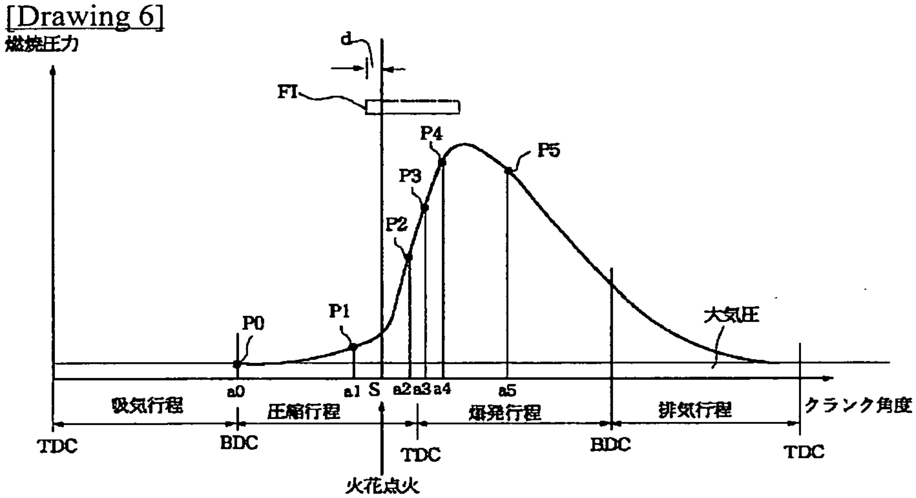
[Drawing 10]



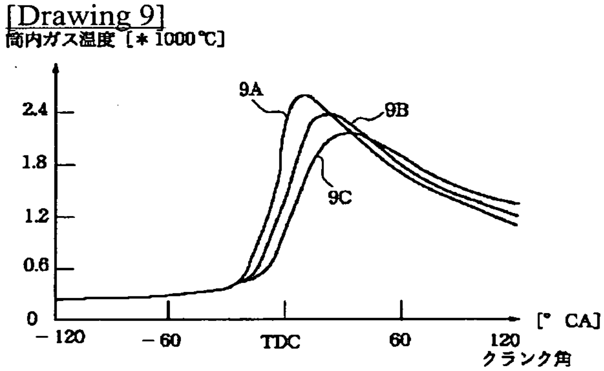
[Drawing 11]



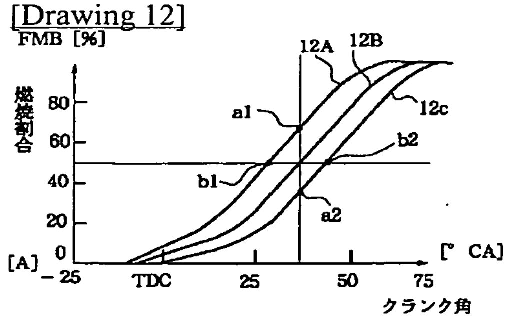
[Drawing 6]



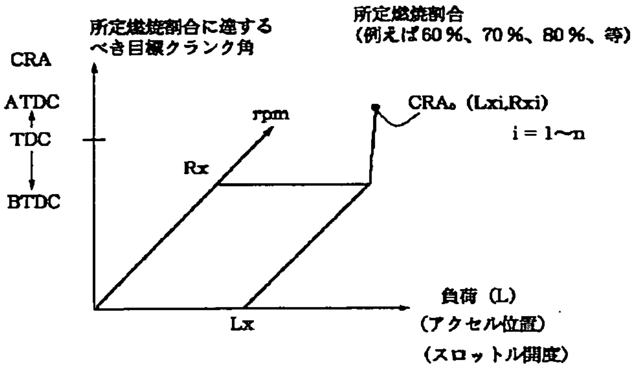
[Drawing 9]



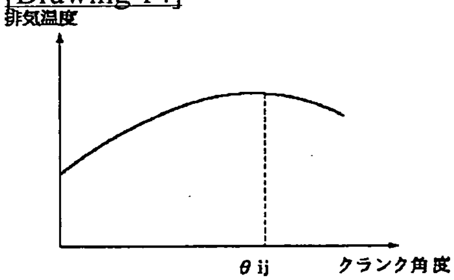
[Drawing 12]



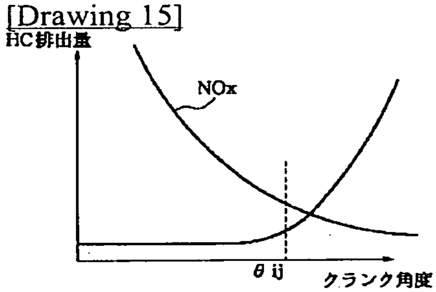
[Drawing 13]



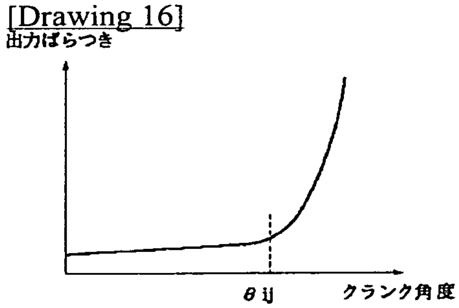
[Drawing 14]



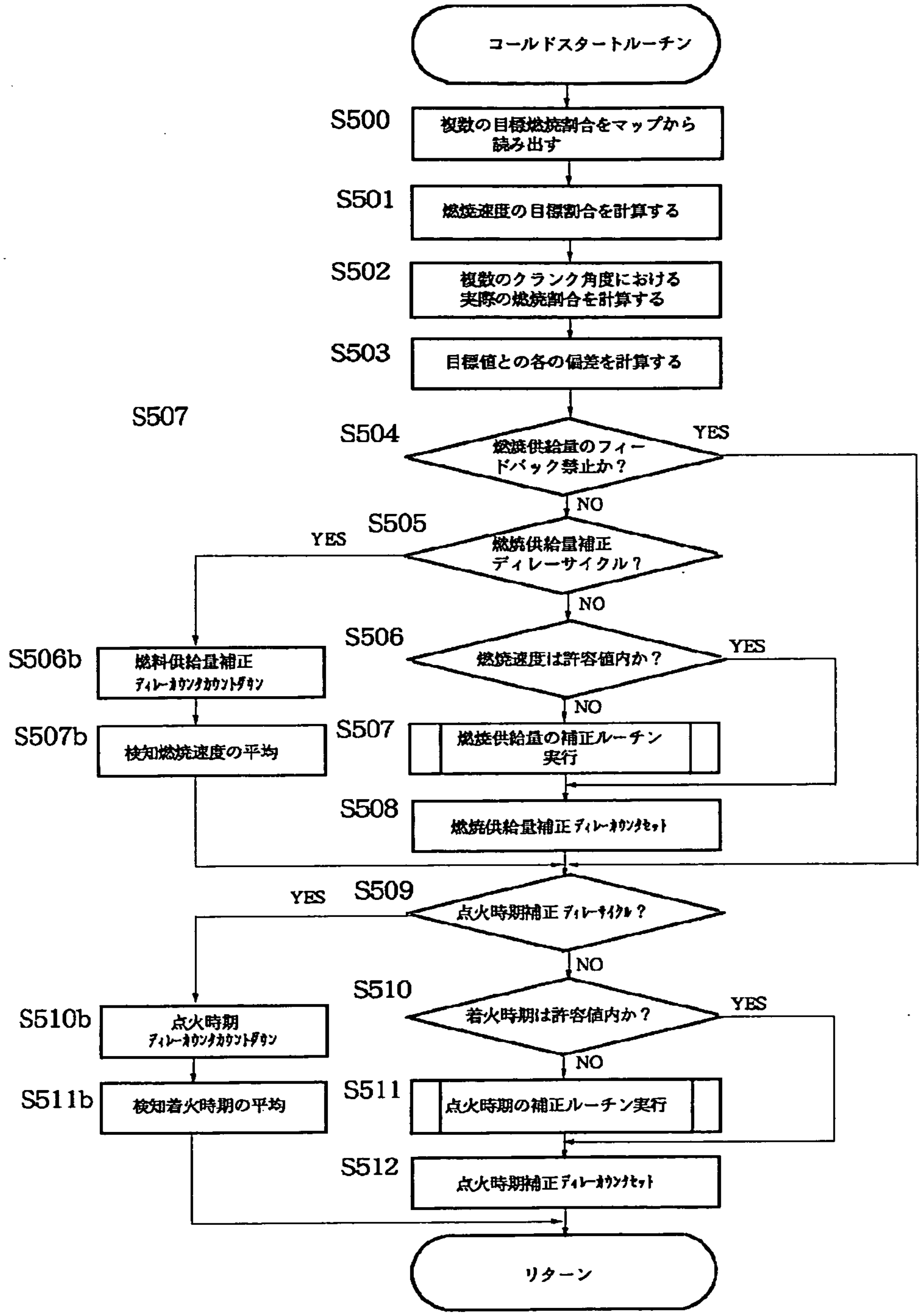
[Drawing 15]



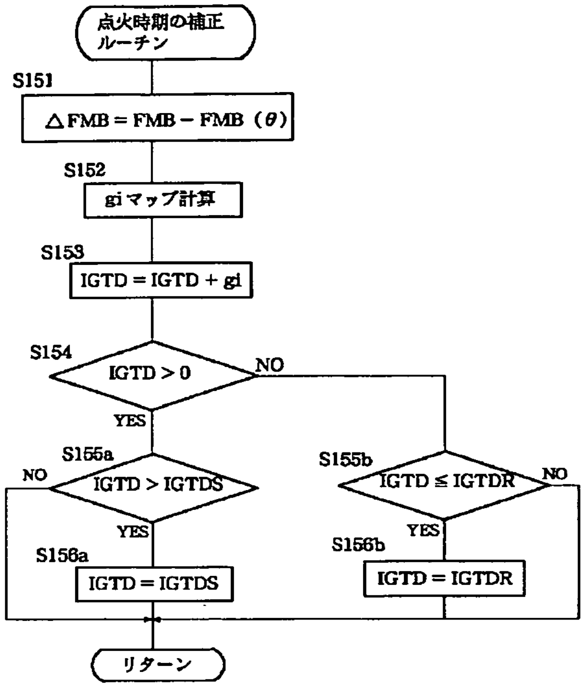
[Drawing 16]



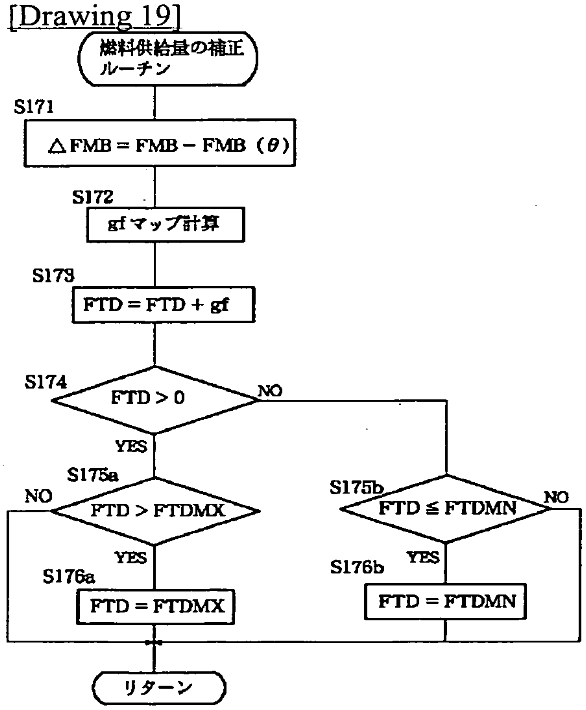
[Drawing 17]


コールドスタートルーチン
S500
複数の目標燃焼割合をマップから読み出す
S501
燃焼速度の目標割合を計算する
S502
複数のクランク角度における実際の燃焼割合を計算する
S503
目標値との各の偏差を計算する
S507
S504
燃焼供給量のフィードバック禁止か？
YES
NO
S505
燃焼供給量補正ディレーサイクル？
YES
NO
S506
燃焼速度は許容値内か？
YES
NO
S506b
燃料供給量補正ディレーカウンタカウントダウン
S507b
検知燃焼速度の平均
S507
燃焼供給量の補正ルーチン実行
S508
燃焼供給量補正ディレーカウンタセット
S509
点火時期補正ディレーサイクル？
YES
NO
S510
着火時期は許容値内か？
YES
NO
S510b
点火時期ディレーカウンタカウントダウン
S511b
検知着火時期の平均
S511
点火時期の補正ルーチン実行
S512
点火時期補正ディレーカウンタセット
リターン

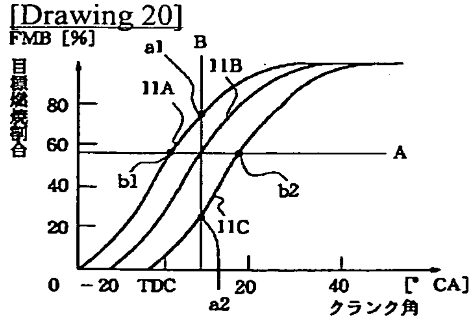
[Drawing 18]



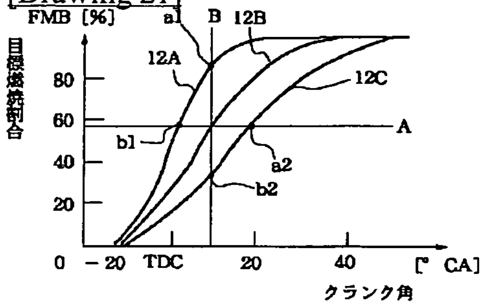
[Drawing 19]



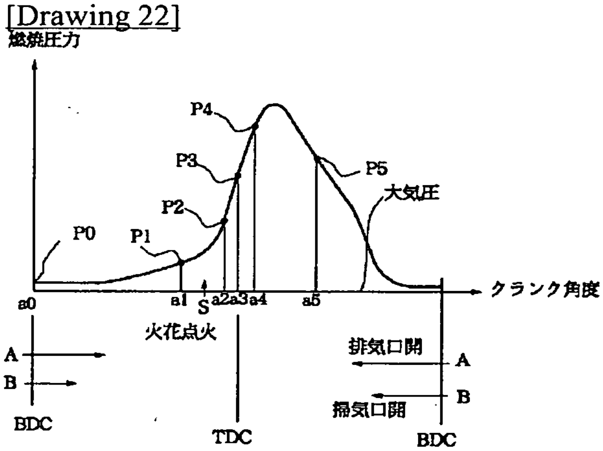
[Drawing 20]



[Drawing 21]



[Drawing 22]



[Translation done.]